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reconsideration of the subject application, particularly in view of the following remarks.

The invention claimed by Applicants is *a polymer electrolyte membrane fuel cell stack* comprising a plurality of *substantially planar* fuel cell units, each of which comprises an anode electrode, a cathode electrode and a polymer electrolyte membrane disposed between the anode electrode and the cathode electrode. A metal bipolar plate is disposed between the anode electrode of one fuel cell unit and the cathode electrode of an adjacent fuel cell unit in the fuel cell stack. The metal bipolar plate comprises a chromium-nickel *austenitic* alloy, wherein the chromium and the nickel, on a combined basis, comprise at least about 50% by weight of the alloy. In accordance with the pages from the ASM Specialty Handbook - Stainless Steels enclosed herewith, *austenitic* alloys represent one of five classifications of stainless steels, four of which, including austenitic stainless steels, are defined on *the characteristic crystallographic structure/microstructure of the alloys* in the family. The five classifications are ferritic, martensitic, austenitic, duplex and precipitation-hardenable alloys. That is, ***it is the structure of the stainless steel that determines the classification - not the composition.***

As discussed at page 3, line 10 to page 11, line 7 of the subject application, to be acceptable for use in a polymer electrolyte membrane (PEM) fuel

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cell, the bipolar plates must provide high electronic conductivity, low corrosion, good chemical compatibility with other components of the fuel cell, low cost, low weight, low volume, sufficient strength, suitability for thermal control and suitability for fabrication. Stainless steel, which is chemically unstable in the PEM fuel cell environment and which has a high corrosion current when in contact with the acidic electrolytic membrane in the operation region of the PEM fuel cell and, thus, cannot work if the pH is less than 5, is conventionally rendered suitable for use in the fuel cell environment by applying a protective coating. As discussed at page 7, lines 16-20 of the subject application, *no protective coating of the bipolar plate of this invention is required*. Thus, Applicants have discovered a composition suitable for use in a bipolar plate for a proton exchange membrane fuel cell stack which, unlike conventional systems, *unexpectedly* does not require the use of a protective coating in order to be effective in the fuel cell environment.

MPEP § 716.02(a) states:

“Evidence of unobvious or unexpected advantage properties, such as superiority in a property the claimed compound shares with the prior art, can rebut *prima facie* obviousness.”

Likewise, MPEP § 716.02(a) also states:

“Absence of an expected property which a claimed invention would have been expected to possess based upon the teachings of the prior art is evidence of non-obviousness.”

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Claims 1-8, 10, and 12-17 have been rejected under 35 U.S.C. 102(e) as being anticipated by Hornung et al., U.S. Patent 6,300,001 B1 (hereinafter “the Hornung et al. patent”). This rejection is respectfully traversed. The Hornung et al. patent teaches a polymer electrolyte membrane fuel cell having a bipolar plate and/or current collector made of an *iron-based material* selected from alloys having Cr content in the range of 8.25% to 46.5% by weight and Ni content in the range of 2.25% to 40.5% (Col. 1, lines 60-67). *Nowhere does the Hornung et al. patent teach or suggest that the material of the bipolar plate and/or current collector is **austenitic stainless steel**.* Indeed, nowhere in the Hornung et al. patent is there even any reference or mention of the term austenitic. As previously indicated, composition of a stainless steel material is not determinative of whether or not the stainless steel has austenitic characteristics - i.e. *the characteristic crystallographic structure/microstructure* of an austenitic material.

The term “iron-based” as used by the Hornung et al. patent is defined at Col. 2, lines 10-15 as meaning that *Fe (iron) is the main component*. In addition, the Hornung et al. patent specifically states at Col. 2, lines 15-18 that it is directed to iron-based alloys having one of the compositions set forth in the unnumbered table beginning at Col. 1, line 61 and extending to Col. 2, line 8. Applicants respectfully urge that *a substantial portion of the compositions set forth therein are, in fact,*

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*excluded from the scope of the invention disclosed by the Hornung et al. patent by virtue of the fact that they do not qualify as iron-based alloys.* For example, given the ranges of elements set forth in the aforementioned table, one possible composition for the alloy is one which contains 46.5 weight % Cr, 14.0 weight percent Mo, and 39.5 weight % Ni, the sum of which constitutes 100% of the composition and which contains no iron. Thus, although such a composition is shown as being possible, it fails to fall within the invention described by the Hornung et al. patent because it contains no iron and, thus, does not constitute an iron-based alloy. Indeed, compositions comprising, for example, Ni and Cr on a combined basis of 80%, which is within the range of compositions of the invention claimed by Applicants, are outside of the teachings of the Hornung et al. patent because they are not iron-based as required by the teachings of the Hornung et al. patent. *Preferably*, the Fe-based material of the Hornung et al. patent has a Cr content in the range of 16.25% to 25.0% by weight and a Ni content in the range of 4.5% to 26.0% by weight (Col. 2, lines 23-39). Applicants note that *the highest preferred Ni content of the alloy taught by the Hornung et al. patent is 26% by weight.* The Hornung et al. patent also teaches *six preferred embodiments, each of which employs a combined Cr-Ni content of less than 50% by weight of the alloy* (Col. 3, line 40 to Col. 4, line 27) contrary to the requirements of the invention claimed by Applicants.

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The Examiner alleges that the Hornung et al. patent teaches a bipolar plate and/or current collector made from a chromium-nickel austenitic alloy, with chromium and nickel combined at 10.5 - 21.0% to 51.0-87.0% by weight, with the alloy further comprising C, *inter alia*. The Examiner further argues that the highest amounts of chromium and nickel combined taught by the Hornung et al. patent, namely 51.0 - 87.0% by weight, meet the limitation of at least about 50% by weight of the alloy claimed by Applicants. Applicants respectfully disagree.

The basis for rejection of the claims by the Examiner is the broadest ranges of Cr and Ni content taught by the Hornung et al. patent. However, the mere teaching of an overlapping range by the prior art is not, by itself, necessarily determinative of the issue. MPEP §2131.03 states that when the prior art discloses a range which touches, overlaps or is otherwise within the claimed range, but no specific examples falling within the claimed range are disclosed, such teachings do not constitute *prima facie* anticipation. Rather anticipation is to be determined on a case by case basis. In *In re Petering*, 301 F.2nd 676, 682, 133 USPQ 275, 280 (CCPA 1962), the court found that claims to a titanium (Ti) alloy with 0.6-0.9% nickel (Ni) and 0.2-0.5% molybdenum (Mo) were anticipated by a graph in a Russian publication on Ti-Ni-Mo alloys because the graph contained *an actual data point* corresponding to a Ti alloy containing 0.25% Mo and 0.75% Ni, and this composition

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was within the claimed range of compositions. Such is not the case with the teachings of the Hornung et al. patent.

Indeed, *the highest Ni content set forth by way of example or description of preferred embodiments in the Hornung et al. patent is 26% by weight.* In addition, the trend *in all* of the preferred embodiments cited by the Hornung et al. patent is *in the direction of alloys comprising less than 26% by weight Ni*, a teaching *away from* the invention claimed by Applicants. According to the above cited section of the MPEP, in order to anticipate the claims, the claimed subject matter must be disclosed in the prior art with “sufficient specificity to constitute an anticipation under the statute.” A determination of “sufficient specificity” is fact dependent. Applicants respectfully urge that *the teachings of the Hornung et al. patent lack the “sufficient specificity” required to constitute an anticipation under the statute.* Applicants note that the combined Cr-Ni content of exemplary/preferred embodiments of the Hornung et al. alloy is less than the minimum 50% combined Cr-Ni content claimed by Applicants. Nowhere does the Hornung et al. patent teach or suggest *with any specificity* the use of an alloy as claimed by Applicants comprising a combined Cr-Ni content of greater than 50%. *Nor is there any hint or suggestion by the Hornung et al. patent of any benefits or other motivations for employing alloys having a Ni content greater than 26%. In contrast thereto, such a benefit has been discovered and*

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*described by Applicants in the subject application, namely that increasing the amount of nickel in the stainless steel bipolar plate reduces the amount of Cr corrosion (page 7, lines 6-7).*

With respect to the requirement of Applicants' claimed invention that the claimed bipolar plate have a nitrogen content of zero, the Examiner argues that the Hornung et al. patent teaches such a limitation. Applicants respectfully disagree. The basis for the Examiner's argument is that nitrogen in an amount of 0.02 wt. % as taught by the Hornung et al. patent corresponds to a zero amount of nitrogen when rounded to the nearest tenth. Applicants respectfully urge that such an application of the prior art is improper. Using the Examiner's application of the prior art, one could also arrive at the conclusion that a metal alloy having 0.2% by weight nitrogen also has a nitrogen content of zero when rounded to the nearest whole number.

The issue of nitrogen is discussed at paragraph [0017] of the subject application where it is stated that *nitrogen is conventionally used in austenitic alloys to enhance the strength of the alloy and to prevent corrosion and pitting of the alloy.* However, the consequence of enhancing the strength of the alloy by the addition of nitrogen thereto is a reduction in the formability of the alloy. Thus, *reducing the nitrogen content of the austenitic alloy to zero as claimed by Applicants for the benefit of enhancing formability of the alloy negatively impacts the strength of the austenitic*

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*alloy and the resistance of the alloy to corrosion and pitting.* It is, thus, surprising and unexpected that the bi-polar separator plate of the invention claimed by Applicants exhibits superior resistance to corrosion and pitting in the acid reducing environment of the polymer electrolyte membrane fuel cell stack in spite of having a nitrogen content of zero. Applicants respectfully urge that the Hornung et al. patent neither teaches nor suggests a bipolar separator plate constructed of a metal alloy, much less an austenitic stainless steel alloy, having a nitrogen content of zero. Accordingly, for the reasons set forth herein above, Applicants respectfully urge that the Hornung et al. patent does not anticipate the invention claimed by Applicants in the manner required by 35 U.S.C. 102(e).

Claims 9 and 11 have been rejected under 35 U.S.C. 103(a) as being unpatentable over the Hornung et al. patent in view of Koncar et al., U.S. Patent 5,942,247 (hereinafter "the Koncar et al. patent"). This rejection is respectfully traversed. Applicants' arguments with respect to the Hornung et al. patent as set forth herein above are equally applicable to this rejection and, thus, will not be repeated. The Koncar et al. patent is relied upon by the Examiner as teaching a polymer electrolyte membrane fuel cell stack employing graphite bipolar plates, based upon which the Examiner argues that it would have been obvious to one of ordinary skill in the art to utilize a graphite bipolar plate in the apparatus of the Hornung et al.



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patent to arrive at the invention claimed by Applicants. Applicants respectfully urge, however, that the use of a graphite bipolar plate in the apparatus of the Hornung et al. patent would not result in the invention claimed by Applicants because the Hornung et al. patent neither teaches nor suggests a polymer electrolyte membrane fuel cell stack having current collectors constructed of austenitic stainless steel alloys as claimed by Applicants. Accordingly, Applicants respectfully urge that the Hornung et al. patent and the Koncar et al. patent, alone or in combination, do not render Applicants' claimed invention obvious in the manner required by 35 U.S.C. 103(a).

Claims 1-17 have been rejected on the ground of non-statutory obviousness-type double patenting as being unpatentable over Claims 1-15 of U.S. Patent 6,723,462 (hereinafter "the '462 patent") in view of Kanter, U.S. Patent 3,754,899 (hereinafter "the Kanter patent"). This rejection is respectfully traversed. The '462 patent claims a polymer electrolyte membrane fuel cell stack having a bipolar separator plate and/or current collector made of a chromium-nickel austenitic stainless steel alloy with chromium and nickel combined comprising at least about 50% by weight of the alloy and with nickel comprising greater than 32% by weight of the alloy. Nowhere does the '462 patent teach or suggest a polymer electrolyte membrane fuel cell stack having a bipolar separator plate and/or current collector made of a chromium-nickel austenitic stainless steel alloy with chromium and nickel

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combined comprising at least about 50% by weight of the alloy *and having zero nitrogen content* as required by Applicants' claimed invention. The Kanter patent teaches austenitic *iron-based* alloys for use *at elevated temperatures above about 1000°F* comprising chromium, nickel and boron (Col. 1, lines5-19). The alloys are indicated to be substantially free of nitrogen, based upon which the Examiner argues that it would be obvious to modify the apparatus of the '462 patent by ensuring a zero amount of nitrogen in the austenitic stainless steel employed in the bipolar plate to arrive at the invention claimed by Applicants. The motivation for such a modification is indicated by the Examiner to be to stabilize the alloy at elevated temperatures. Applicants respectfully disagree.

It is well known to those skilled in the art that polymer electrolyte membrane fuel cells operate at temperatures less than about 160°C (320°F). Thus, an austenitic stainless steel which is able to withstand temperatures of greater than 1000°F as taught by the Kanter patent *is not* an issue for austenitic stainless steel alloys employed in polymer electrolyte membrane fuel cells. Accordingly, Applicants respectfully urge that there would be no motivation for one skilled in the art to modify the austenitic stainless steel of the bipolar plate of the '462 patent by ensuring a nitrogen content of zero as claimed by Applicants, based upon the teachings of the Kanter patent, since such a modification would not provide any benefit in the

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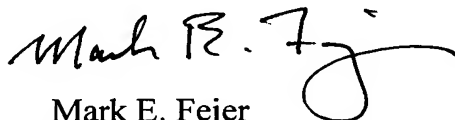
temperature regime of the polymer electrolyte membrane fuel cell. Accordingly, Applicants respectfully urge that the '462 patent and the Kanter patent, alone or in combination, do not render Applicants' claimed invention obvious.

### **Conclusion**

Applicants intend to be fully responsive to the outstanding Office Action. If the Examiner detects any issue which the Examiner believes Applicants have not addressed in this response, Applicants urge the Examiner to contact the undersigned.

Applicants sincerely believe that this patent application is now in condition for allowance and, thus, respectfully request early allowance.

Respectfully submitted,

A handwritten signature in black ink, appearing to read "Mark E. Fejer", with a stylized flourish at the end.

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